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AUTHOR Broselow, Ellen
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ABSTRACT

It is proposed that error patterns in acquisition of a second language can provide otherwise unavailable evidence for testing linguistic hypotheses about the second language itself. Three types of production and perceptual error patterns found in the learning of English by native Arabic speakers are outlined to support this suggestion. The error patterns discussed involve learner errors that can be seen as resulting from transfer of rules or principles of the learner's native language grammar, including the breaking up of consonant clusters, and two types of incorrect segmentation of strings into words, either by segmentation into two nonexistent words or mis-organization of syllables. (MSE)

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Metrical Phonology and the Acquisition of a Second Language

Ellen Broselow
State University of New York at Stony Brook

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0.1 Introduction

This paper discusses several errors in both the production and perception of a foreign language, and offers accounts of these error patterns in terms of a particular theory of the representation of phonological structure. The specific aim of the paper is to present some data and some analyses of the data, but there are two general aims as well. First, I'd like to argue that formal theories of phonology may be of use in the task of accounting for the facts of second language acquisition, by presenting cases in which the error patterns of language learners can be seen as perfectly comprehensible and even predictable given particular theoretical constructs. My second aim is to argue for the relevance of data from second language acquisition to the concerns of linguistic theory. One sort of case in which a study of second language acquisition can be most useful involves learners' errors which can be argued to result from transfer of rules or principles of the learner's native language grammar. Errors of this type provide evidence for particular analyses of the native language grammar, evidence that may not be available from study of the native language alone.

0.2 Production Errors

The first sort of error to be discussed involves the breaking up of consonant clusters in English by native speakers of two dialects of Arabic, Egyptian and Iraqi. The facts, discussed in greater detail in Broselow 1983, are summarized in (1) on the handout, where you can see that Egyptians speaking English tend to insert a vowel between the two consonants of an initial cluster or after the second of three consonants word-internally. Iraqis, on the other hand, insert a vowel <u>before</u> two initial consonants or after the <u>first</u> of three medial consonants. In a theory which recognizes the grouping of segments into larger units--syllables, in this case--the processes of initial and medial epenthesis used by the speakers of each language can be described as a single process designed to transform English strings into pronounceable Arabic syllables. The maximal syllable in both Egyptian and Iraqi is CVC, with the exception of word-initial syllables, which may have complex onsets in Iraqi. Consonants which are not syllabifiable by the rule in (2a) provide the environment for epenthesis. The two languages differ only in the directionality of epenthesis; for Egyptian speakers, an epenthetic vowel is inserted to the right of the leftover consonant, while for Iraqis, a vowel is inserted to the left, rendering the English word 'translate', for example, as [ti-ran-si-let] in Egyptian

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pronunciation but as [it-ran-is-let] in Iraqi. The rules in (2) treat initial and medial epenthesis as the same process and provide a nice account of the different position of the epenthetic vowels in the two languages: the analysis suggests that the two environments in (3a) are actually the same environment, as are those in (3b), so that their conjunction as epenthesis environments in a language is precisely what is expected. The forms in (4) show that these epenthesis rules seem to operate in the native languages as well as in the speech of Egyptians and Iraqis learning English, and therefore we can assume that the rules in (2) are transferred from the learners' native grammars. But what is interesting is that while the facts of Egyptian Arabic provide clear cases of medial epenthesis --which is an extremely productive, post-lexical rule in the language-- the facts concerning initial epenthesis in this language are much less clear, and in fact it is difficult to motivate the initial epenthesis rule in (2b) on the basis of the facts of Egyptian Arabic. When we consider the data from second language acquisition, however, we find epenthesis in just the environments in (3a)-- exactly the conjunction of environments which is predicted by the theory. Thus the syllabic theory of epenthesis is confirmed by the second language data, and offers a principled account of learners' errors.

0.3 Perception Errors: Word Juncture

The second sort of error I will discuss here may also be accounted for by differences in the syllabic structure of English and ARabic. These errors, however, involve the perception rather than the production of foreign language strings. These are errors commonly made by English speakers learning Arabic, and they involve the incorrect segmentation of strings into words. There are two types of phrases which tend to be incorrectly parsed by English learners: phrases like the one in (5a), which is often interpreted as consisting of the two nonexistent words in (5b), and phrases like those in (5c), which is heard as (5d). These error patterns are more or less universal among English learners of Egyptian Arabic, and occur even when the learner is confronted with phrases containing familiar words and when syntactic and pragmatic cues lead the learner to expect to hear those familiar words.

It is argued in Broselow 1984 that this error is attributable to a difference in restrictions on the possible relationships between word boundaries and syllables in English and Egyptian Arabic. It has long been recognized that in English, various phonetic cues such as aspiration and consonant duration signal junctural differences, such as the difference between <u>a tease</u> and <u>at ease</u>, and it has been argued by, for example, Kahn 1976 and Church 1983, that the allophonic differences in consonants that signal differences in juncture are conditioned by the position of a consonant in a syllable. We may explain English speakers' misparsings of Egyptian Arabic, then, by assuming that the phonetic cues indicating a segment's position in a syllable are roughly equivalent in English and Arabic, but that the inventory of syllable types and the principles organizing syllables into words are different in the two languages. In Egyptian Arabic, a syllable may begin with one and only one consonant. A word, on the other hand, may begin with a consonant cluster, such as the <u>sm</u> of <u>smiina</u>. The phrase <u>binti smiina</u> is syllabified in accord with the prohibition against

syllable-initial clusters. The syllable structure of this phrase is shown in (6a). Note that the word boundary in (6a) does not coincide with a syllable boundary. The s of smiina is part of the second word, but is contained within a syllable which also contains the last two segments of the first word. In English, on the other hand, both words and syllables may begin with consonant clusters. Thus in the English phrase a smoker, for example, the word boundary coincides with a syllable boundary. In English, then, a consonant cannot be moved leftward across a word boundary to join the final syllable of a preceding word. Egyptian Arabic, on the other hand, does allow--and in some cases require--this sort of resyllabification. If we assume that the phonetic cues indicating whether a consonant is syllable-initial or syllable-final are roughly equivalent in English and Arabic, then what is happening here is that the English speaker hears the syllable structure of Arabic phrases such as the ones in (5) correctly, but interprets these structures in terms of the restrictions on the relationship between syllable boundaries and word boundaries which obtain in English. Since in English the beginning of a word also generally coincides with the beginning of a syllable, the English speaker incorrectly segments the Arabic strings into words. (6a) shows both the Arabic syllabification of this string and the syllabification of a segmentally analogous English phrase.

The explanation of the misparsing of (5c) as (5d) depends on a slightly more subtle difference between Arabic and English syllable structure. In English, we find differences between pairs such as a tease and at ease, differences which depend on the differing syllable position of the t. Here I adopt the analysis of English syllable structure, in which the word-final t in at ease is analyzed as ambisyllabic-- connected both to the vowel of at and the vowel of ease-- with ambisyllabicity conditioning the flapping of the t. Thus in English, a tease and at ease can be argued to have different syllable structures, with the word-initial consonant analyzed as unambiguously syllable-initial and the word-final consonant analyzed as ambisyllabic, and with various phonetic effects resulting from these differences. But in Arabic, such a difference seems to be impossible; as best as I can tell from measurements of Arabic pairs like those in (7), a word-final consonant followed by a vowel in Arabic is completely resyllabified into the onset of the following word; thus, there's no significant durational difference between the underlined ls in (7a) and (7b). An English speaker hearing the first phrase in (6a), then, will presumably hear phonetic cues which signal that the word-final consonant is unambiguously syllable-initial. Since in English a word-final consonant can be at most ambisyllabic, but cannot completely resyllabified into the onset of the following word, the correct Arabic parsing of the string into words will be incompatible with English principles. This sort of evidence provides additional support for the analyses of syllabification rules in both English and Arabic, evidence of the sort which is not available if one looks only at one or the other language. Nice confirmation of this difference in the resyllabification possibilities of English and Arabic is provided in (8), which shows an Arabic speaker's metrical parse of a line from Poe's The Raven; this speaker consistently assigns word-final consonants to the syllable of the following vowel, something which we would not expect an English speaker to do.

Thus differences in the syllabic structure of English and Arabic play a significant role in errors in production and perception by learners of these languages. But larger aspects of metrical organization also play a role in learners' errors. I will just briefly mention one other sort of phonetic cue

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which may have different interpretations in different languages and which may therefore lead to errors in the perception of a foreign language. Again, this example involves the segmentation of strings into words. The sorts of errors illustrated in (5) involve the incorrect assignment of segments to words-- in (5b), for example, the learner has assumed that since the s is syllable-final, it could not be word-initial. But notice that while this account provides an explanation of why the correct segmentation of the phrase in (5a) is not the one chosen by English speakers, it does not rule out other possible parsings of this phrase. The phrase contains four syllables; presumably any one of them could be analyzed as beginning a word. The parsings in (9) are all logically possible, and all are consistent with the syllabification rules of English words. Yet the preferred parsing seems to be as in (5b), into two words of two syllables each. Thus a complete account of second language errors must must provide an explanation of why the particular parsing of (5b) is preferred over the possibilities outlined in (9). I will just briefly suggest the sorts of factors that might account for errors in grouping syllables into words in a foreign language. It seems clear that English speakers make use of the stress pattern of a string in making segmentation decisions; thus Taft (1983) has presented evidence that English speakers prefer segmentations in which stressed syllables are word-initial. Even more subtle aspects of the rhythmic structure of a string may play a role in segmentation, however. One of these factors is the duration of syllables. It has been argued by Nakatani and Schaffer that monosyllabic words are lengthened in English, so that a monosyllabic content word is generally longer than any syllable of a multisyllabic word. English speakers are apparently able to make use of this length difference to segment strings into words in the absence of any other cues to word membership. The evidence is provided by an experiment making use of so-called reiterant speech, in which each syllable of various English trisyllabic phrases was replaced by the syllable ma. This technique has the effect of removing all phonemic information but leaving the prosodic pattern--stress, length, and intonation--intact. The removal of phonemic content from phrases with similar stress patterns, such as long stampede and noisy dog, created strings which would presumably be ambiguous between a 1#2 segmentation and a 2#1 segmentation. Subjects were asked to indicate whether each of these phrases consisted of a monosyllabic adjective followed by a disyllabic noun (1#2) or a disyllabic adjective followed by a monosyllabic noun (2#1). The experiment revealed that English-speaking subjects could determine with an accuracy significantly greater than chance whether a phrase was of the type 1#2 or 2#1. Various instrumental manipulations suggested that it was the length of syllables rather than their pitch or amplitude which subjects used in determining which syllables replaced single words: a syllable with a longer-than-normal vocalic nucleus was identified as a monosyllabic word. This effect is attributable to a rule of English which lengthens monosyllabic words, referred to by Nakatani and Schaffer as Monosyllabic Word Elongation. A pilot study on the segmentation of Arabic four-syllable phrases into words by English speakers indicates that this rule of Monosyllable Word Elongation may also be applied to the segmentation of foreign language strings. I asked nine native speakers of English to segment a group of Arabic phrases into two words. The tape contained a total of sixteen phrases, each consisting of two disyllabic words, read by a native speaker of Arabic. Eight of these phrases had the stress pattern sw#sw, while the other eight had the pattern sw#ws. Subjects were presented with a phonetic transcription of each phrase, with no indication of word boundary position,, and were directed to make their best guess concerning the position of the word boundary in each phrase and to indicate this position by

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drawing a line between the last segment of the first word and the first segment of the second word. As (10) shows, the preferred segmentation for strings of both types was 2#2--which was in fact the actual segmentation of these phrases in Arabic. There was only one sort of phrase in which the majority of English speakers preferred a 3#1 parsing --that is, where they heard the four-syllable phrase as consisting of a trisyllabic word followed by a monosyllabic word. This was the case in which the final syllable of the phrase contained a long a. In Egyptian Arabic, a word-final syllable is stressed under one of two conditions: when it is closed by two consonants (CVCC, where C represents any consonant and V any vowel) or when it contains a long vowel. Two of the swows phrases had final syllables ending in two consonants and six had phonemically long vowels in their final syllables. Of the six phrases with long final vowels, four contained high vowels (ii or uu) while two contained the low vowel represented phonemically as aa, though its phonetic value is closer to the English mid front lax vowel E. (11) shows that most of the 3#1 responses are responses to the phrases containing a long final a. Thus a final stressed syllable containing the vowel aa was much more likely to be identified as a monosyllabic word than a final syllable containing a long i or u or one with a short vowel followed by two consonants. To explain this, it is necessary to look at the correspondences between Arabic and English vowels. In American English, the high tense vowels i and u are generally longer than the corresponding lax vowels, though the vowels of bead and bid differ in quality as well as in length. In Arabic, however, length per se does have a phonemic function; long i and short i, differing only in length, are different phonemes, and Arabic speakers tend to analyze the tense/lax distinction in English as a length distinction. The Arabic vowels which are most similar in both quality and length to the English i and u are the long versions of i and u. Thus it seems reasonable that English speakers hear a long i or u in Arabic as a short (normal) vowel, rather than an overly long vowel.

The story is different with Arabic a, however. Again, Arabic has a phonemic contrast between long and short a. The English vowel which most closely corresponds in quality to Arabic a is the mid front lax vowel E, as in red. This vowel is not diphthongized in English and therefore is normally shorter than English i or u (compare the length of reed, rude, and red in American speech). The length of Arabic long a is therefore much noticeable to an American speaker, and this vowel is less likely to be identified with a normal--that is, non-lengthened--American vowel than is long i or long u. Given these correspondences, we would expect an English speaker to be less likely to hear a long i or long u in Arabic as a lengthened vowel than to hear long a as lengthened. And since vowel lengthening is a cue to the presence of a monosyllabic word for English speakers, we would expect phrases containing final syllables with long a to be segmented as 3#1 more often than phrases with final syllables containing long i, u, or short vowels.

Thus the hypothesis that English speakers hear only the long vowel a as abnormally long and analyze the syllable containing this vowel as a monosyllabic word provides an account of the response patterns in (10)-- another case in which a rule of the native language grammar appears to operate in perception of a foreign language. Confirmation of this analysis awaits careful instrumental study of vowel duration in English and Arabic.

0.4 Conclusion

I've discussed three sorts of cases in which particular analyses of the phonological system of a language provide an account of errors in the production or perception of a foreign language. This sort of evidence is interesting to the linguist in that it provides a source of evidence for testing hypotheses which might not be available in the native language itself. Another sort of acquisition data which I have not discussed involves errors in learning a second language which are common in learners of various language backgrounds. These sorts of errors are of course of crucial importance to the linguist, since they may provide provide interesting insights into the universal principles governing [illegible]. The literature on second language acquisition has provided [illegible] of errors of this sort, in particular examples concerning universal principles of organization of segments into metrical units, but discussion of this facts would constitute another paper.

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1.

Egyptians	Iraqis
childiren	chilidren
bilastic	(i)blastic
Fired	(i)fred
tiransilate	(i)tranislate

a. Egyptian rule: insert [i] between two initial consonants and after the second of three consonants.
b. Iraqi rule: insert [i] optionally before two initial consonants and after the first of three consonants.

2. a. Syllabification: Assign segments to syllables, with CVC as maximal syllable, except that complex onsets may occur word-initially in Iraqi.
b. Epenthesis: Insert [i] to the right (Egyptian) / left (Iraqi) of an unsyllabified consonant.

t-ran-s-let -> ti-ran-si-let
-> it-tan-is-let

3. a. #C_C, CC_C
b. #_CC, C_CC

4. Egyptian

katabu	(katab+u)	'he wrote it'
katabtu	(katab+t+u)	'I wrote it'
katablu	(katab+l+u)	'he wrote to him'
katabtilu	(katab+t+l+u)	'I wrote to him'

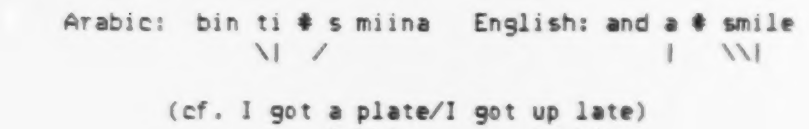
Iraqi

kitaba	(kitab+a)	'he wrote it'
kitabta	(kitab+t+a)	'I wrote it'
kitabla	(kitab+l+a)	'he wrote to him'
kitabitla	(kitab+t+l+a)	'I wrote to him'

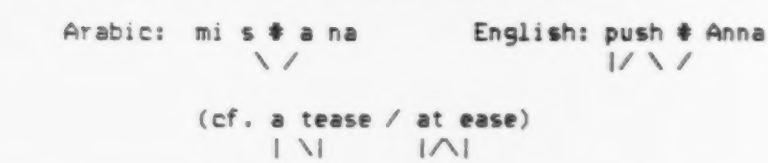
qmaas ~ iqmaas 'cloth'
claab ~ iclaab 'dogs'

5. a. binti # smiina
b. bintis # miina
c. mis # ana
d. mi # sana

6. a. Leftward resyllabification across word boundary



b. Rightward resyllabification across word boundary



7. a. faDDal # ilwalad 'he preferred the boy'
   b. faDDa # lilwalad 'silver to the boy'

8. Poe

9. a. bintismiina
   b. bin # tis # mii # na 1#1#1#1
   c. bin # tis # miina 1#1#2
   d. bintis # mii # na 2#1#1
   e. bin # tismiina 1#3
   f. bintismii # na 3#1

10. Responses by Stress Pattern

	sw#sw	sw#ws
2#2	92%	72%
3#1	4%	25%
1#3	4%	3%
	n=72	n=72

11. Responses by Makeup of Final Syllable

	CVCC	CiiC,CuuC	CaaC
2#2	16	31	5
1#3	0	2	0
3#1	2	3	13

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